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WEATHER AND CIRCULATION OF JANUARY 1972

A Month With Record Strong Midlatitude Westerlies

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1. MEAN CIRCULATION

January 1972 was characterized by an extremely vigorous circulation at midlatitudes around almost the entire Northern Hemisphere, with the exception of the European sector where strong blocking prevailed (figs. 1, 2). The subtropical high-pressure belt was stronger than normal and was displaced north of its usual position all the way from the western Pacific to the central Atlantic, while deeper than normal cyclonic centers of action prevailed at high latitudes over Baffin Island and across northern Siberia.

The 700-mb wind maximum was quite close to its normal position from the central Pacific to the central Atlantic, but mean wind speeds were considerably greater than normal, particularly over North America and the western Atlantic where a peak value of 25 m/s (10 m/s above normal) was observed south of Nova Scotia (fig. 3). Under the influence of the strong European blocking ridge,

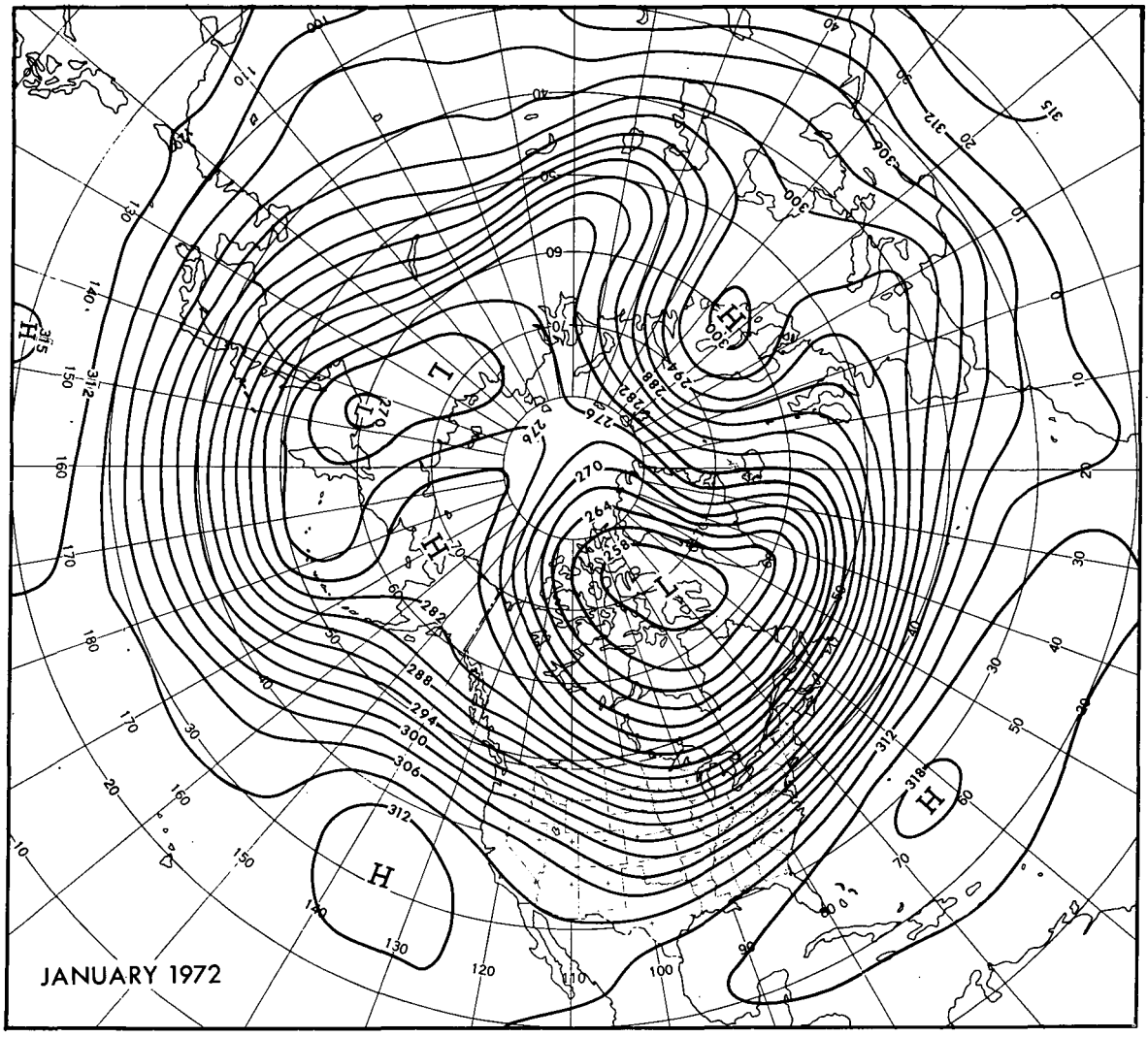


FIGURE 1.—Mean 700-mb contours in dekameters (dam) for January 1972.

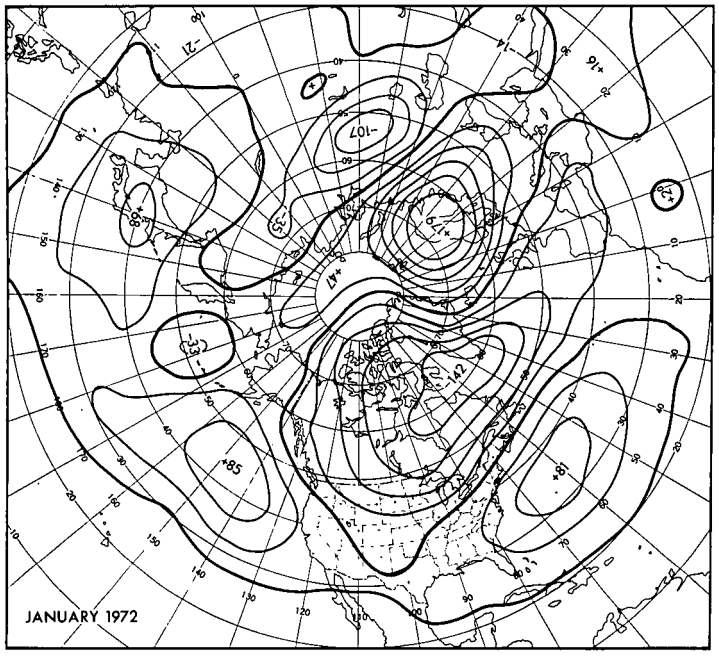


FIGURE 2.—Departure from normal of mean 700-mb height (m) for January 1972.

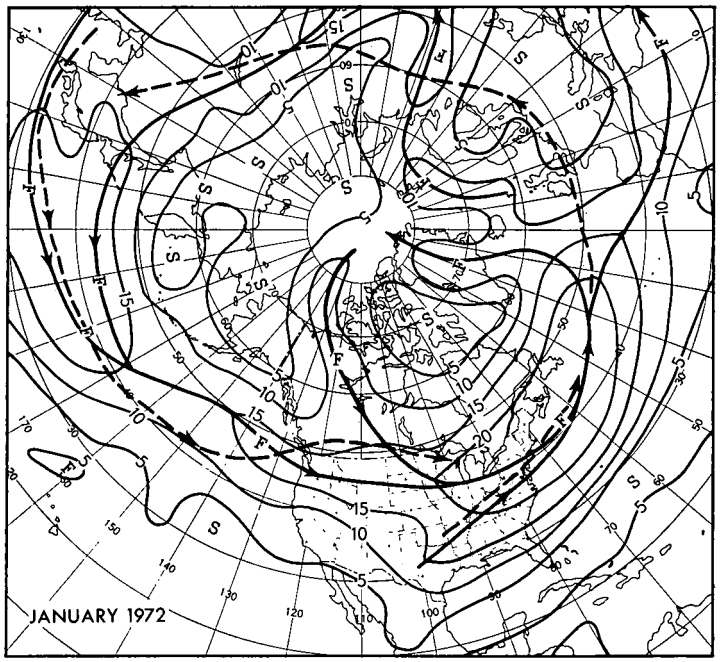


FIGURE 3.—Mean 700-mb geostrophic wind speed (m/s) for January 1972. Solid arrows show the observed axes of maximum wind speed, and dashed lines show the normal January positions. Isotachs are at intervals of 5 m/s.

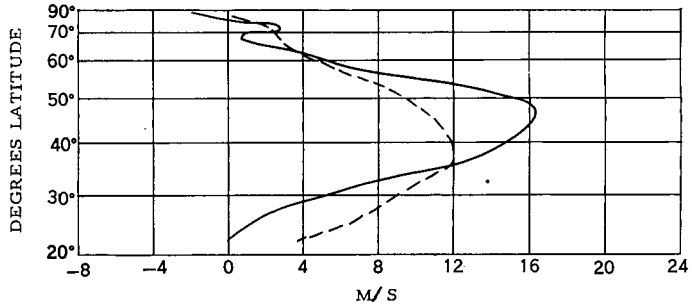


FIGURE 4.—Mean 700-mb geostrophic zonal wind profile (m/s) for January 1972. The observed profile for the western half of the Northern Hemisphere is shown by the heavy solid line, and the normal is given by the dashed line.

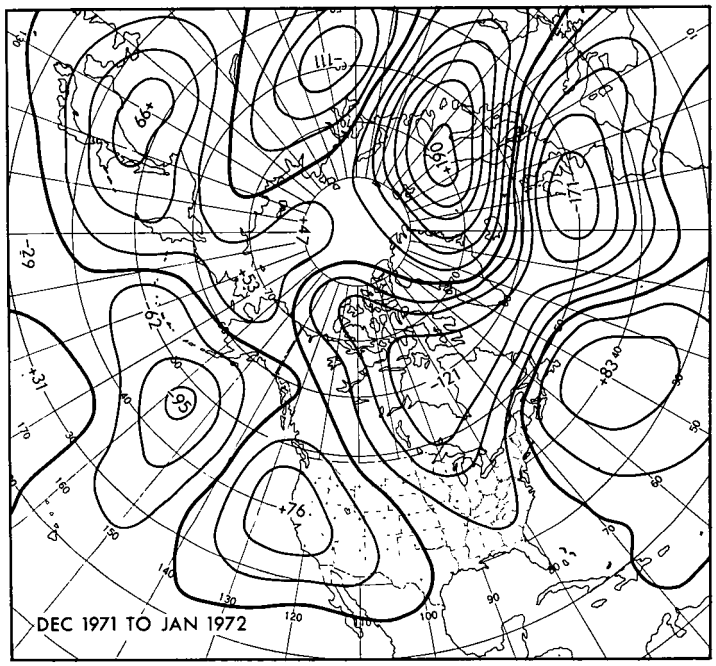


FIGURE 5.—Mean 700-mb height anomaly change (m) from December 1971 to January 1972.

the westerlies split into two branches, with one turning sharply northward over Greenland and the other dropping southeastward over North Africa.

The latitudinal mean 700-mb geostrophic wind profile for the western half of the Northern Hemisphere shows a strong peak of over 16 m/s at about 45° latitude, while the westerlies were weaker than normal at high and low latitudes, particularly the latter (fig. 4). The mean midlatitude 700-mb zonal index of geostrophic wind speed (computed between 35°N and 55°N) was 13.9 m/s, 3.8 m/s above the January normal and the highest such monthly mean index observed in any month since records of this quantity have been kept at the Extended Forecast Division beginning in 1949.

Under the influence of the fast westerlies, the principal mean ridges and troughs progressed from December to January. An increasing tendency toward troughing in the central Pacific began to split the subtropical ridge into two cells, with the eastern one moving from about 150°W to 140°W. The 700-mb height anomaly increased by over 60 m along the United States Pacific coast, and the trough that had been over the West in December (Dickson 1972) moved eastward to the middle of the country in January (figs. 1, 5). Heights continued to fall over Canada, leading to a strong, full-latitude trough over North America. The anomalously strong ridge that

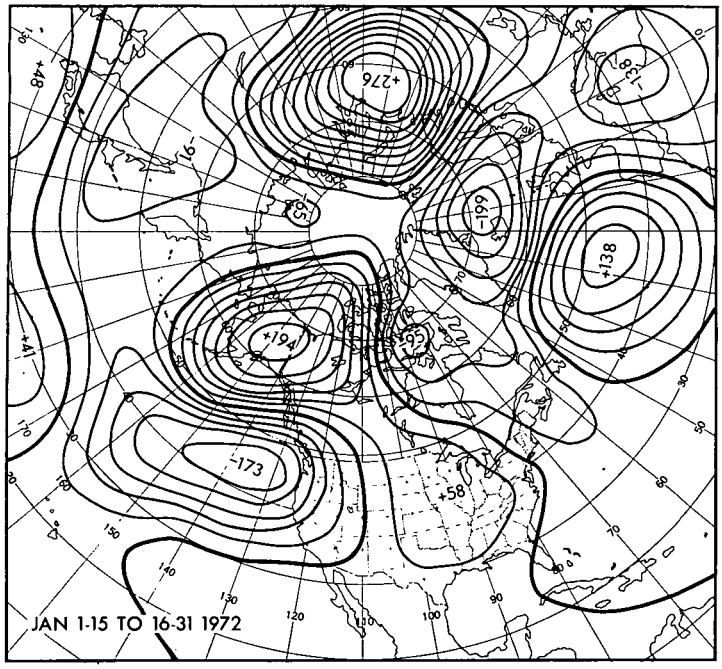


FIGURE 6.—Mean 700-mb height change (m) from the first half to the second half of January 1972.

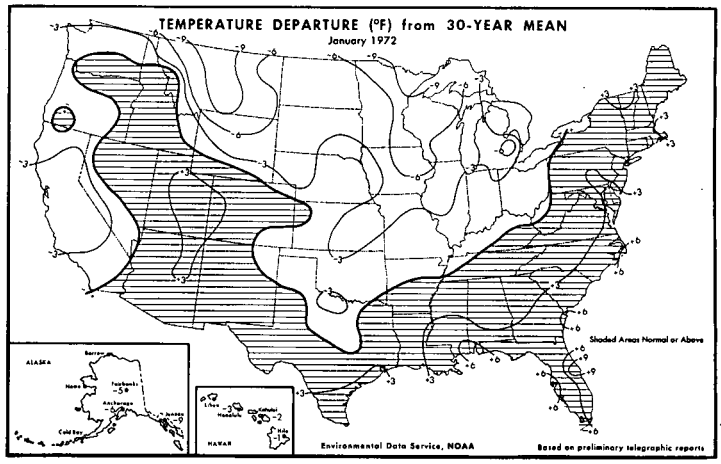


FIGURE 7.—Departure from normal of average surface temperature (°F) for January 1972 (from Environmental Data Service and Statistical Reporting Service 1972).

had helped produce record warmth over the Southeast in December moved farther out into the Atlantic, contributing to a height anomaly increase of 83 m south of Newfoundland. The rapid increase of blocking over northern Europe was accompanied, as is usually the case, by similar strong height falls over Southern Europe and the Mediterranean Sea (fig. 5).

The pattern of 700-mb height change between the first and second halves of January (fig. 6) is also indicative of progression of most large-scale circulation features during the month. Height falls over northeastern Canada and over the western Atlantic marked progression and further deepening of the North American trough. The Atlantic ridge strengthened west of Spain, tending to break the channel of southeastward-moving cyclones and sealing off some of the cyclonic activity in the Mediterranean while forcing the remainder northeastward toward Iceland. The strong blocking ridge over northern and eastern Europe also progressed into western Russia, accompanied by rapid filling of the intense trough northeast of the Caspian Sea.

Part of the contribution to the January mean ridge over the Bering Strait came as a result of a surge of relatively high pressure across the pole from the northern portion of a ridge located in central Asia the previous month (figs. 1, 2). Near the middle of January, this mobile high-latitude feature phased with a portion of the Pacific Ocean high-pressure ridge and led to rapid cyclogenesis as Arctic air from the north was advected over the relatively warm waters of the Gulf of Alaska. This area of storminess sank southward and phased with cyclones coming from the central Pacific trough in the latter part of the month (fig. 6).

2. TEMPERATURE

The temperature was more notable for its unusual variability and rapid changes than for persistent, large anomalies during January. This characteristic is typical of a month with fast-moving synoptic systems at temperate latitudes (Dickson 1971). The temperature anomally pattern quite closely resembled the height anomaly pattern east of the Rocky Mountains (figs. 2, 7). Several outbreaks of bitterly cold Arctic air moved rapidly across the country from the Northern Plains States to the Northeast, and the northern border States from Montana to Michigan were in the grip of Canadian air masses most of the time, averaging 5° to 10° F below normal. Frequent bursts of warm air from the Gulf of Mexico kept the Gulf and Atlantic Coastal States more than 3° F above normal. Although temperatures decreased somewhat from the recordbreaking high levels of December, it was still the warmest January in over 20 yr throughout much of the Southeast. Fort Myers, Fla., reported the second warmest January on record, 70.9° F, which was 7.4° F above normal. At Orlando, Fla., January averaged 8.5° F above normal. New daily records for warmth were set on seven separate occasions at Corpus Christi, Tex.

Air masses with a mostly maritime origin kept temperatures a few degrees above normal over the intermountain States. It was quite cold, however, over the California Central Valley and the western plateau where persistent anticyclonic conditions and fog kept daytime maximum temperatures quite low. The first 11 days of January averaged 16°F below normal at Reno, Nev., under the influence of a strong inversion aided by several inches of snow cover left over from December. Significant air pollution readings were measured on 12 of the first 17 days of January, an unusual event for a relatively small

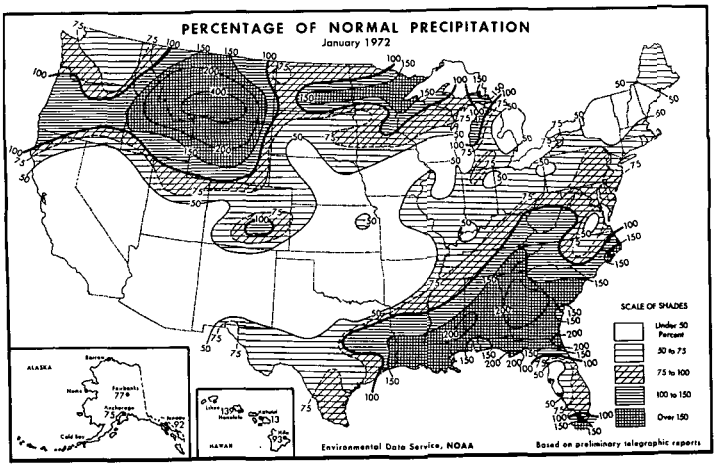


FIGURE 8.—Percentage of normal precipitation for January 1972 (from Environmental Data Service and Statistical Reporting Service 1972).

city in the sparsely populated area of the West. Fresno, Calif., reported its second coldest January (5.5°F below normal) and its lowest average monthly maximum temperature in an 85-yr record. Fog was observed on all but 5 days there and on all but 4 days at Stockton, Calif., which recorded its third coldest January (4.1°F below normal) and lowest average monthly maximum temperature. The temperature at Bakersfield, Calif., averaged 5.8°F below normal.

TABLE 1.—*Stations reporting record and near-record precipitation or snowfall during January 1972*

Station	Amount (in.)	Remarks
Yakutat, Alaska	75. 2	Snowiest January
Stampede Pass, Wash.	230. 1	Do.
Olympia, Wash.	20. 5	24-hr record snowfall on 24th–25th
Eugene, Oreg.	4. 26	24-hr record rainfall on 20th
Billings, Mont.	2. 35	Wettest January
Do.	27. 6	2d snowiest January
Do.	16. 6	24-hr record snowfall for Jan. on 1st–2d; 2d greatest for any month
Sheridan, Wyo.	25. 1	Snowiest January
Sault Ste. Marie, Mich.	53. 2	Snowiest month
Do.	19. 6	Most snow in single storm on 24th–26th
Wilmington, Del.	1. 0	Latest first measureable snowfall on 27th
Los Angeles, Calif.	0. 00	First January without even a trace of rain
Flagstaff, Ariz.	0. 00	Driest January in 73-yr record
Winslow, Ariz.	0. 00	Driest Janury on record
Phoenix, Ariz.	0. 00	Fourth rainless January on record
Tucson, Ariz.	0. 00	First rainless January since 1928
Milford, Utah	0. 05	2d driest January in 64-yr record
Tulsa, Okla.	0. 17	4th driest January on record; driest January since 1943

3. PRECIPITATION

Precipitation was heavier than normal over the northwestern and southeastern quadrants of the Nation, with generally half the normal amounts falling across the middle of the country from the Southwest to the Mississippi Valley and also over much of New England (fig. 8). Several localities in the Southwest reported a completely rainless January (table 1).

The heaviest precipitation totals relative to normal fell over the Northern Rocky Mountain States, with as much as four times the normal in southern Montana. Billings, Mont., reported its wettest and second snowiest January, and Sheridan, Wyo., also had its snowiest January. Other heavy amounts of total precipitation and snow were reported in the Pacific Northwest and across the Upper Mississippi Valley to the Upper Peninsula of Michigan, near the tracks of a majority of the month's storms. The normal gulf coast storm track was inactive, and most of the heavy precipitation in the Southeast was at least partially due to convective activity in the warm sectors of storms farther north.

4. WEEKLY VARIABILITY

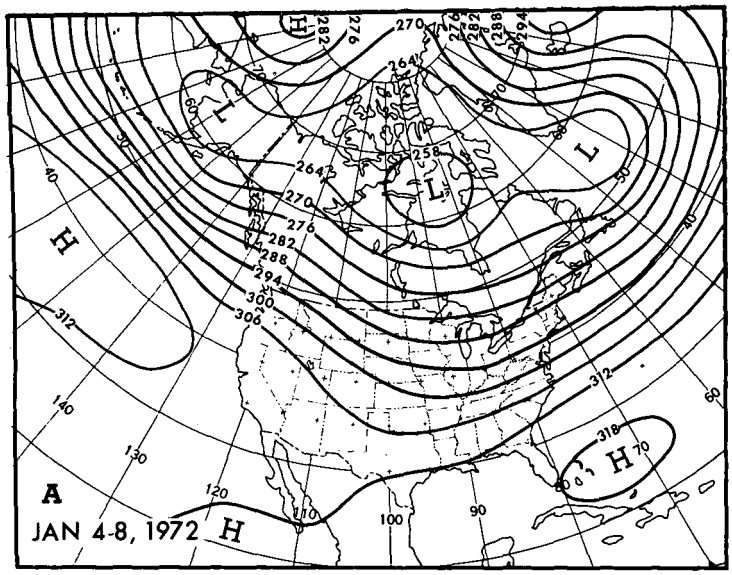
January 3–9

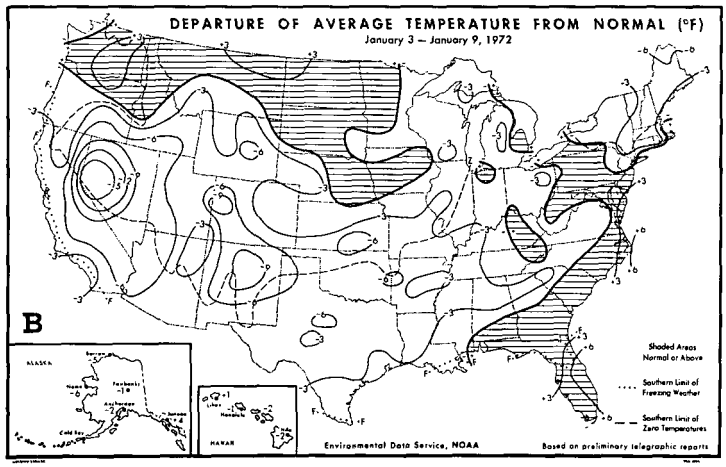
The midlatitude 700-mb flow early in January was quite fast with relatively small amplitude in the planetary waves from the Pacific to the western Atlantic (fig. 9A). As a consequence, temperature anomalies over most of the country were fairly weak except for the western Great Basin and California Central Valley which had pronounced inversion conditions with frequent all-day fog keeping maximum temperatures down (fig. 9B). The South Atlantic Coast States remained quite mild, and Cape Hatteras, N.C., reported 75°F on the 4th, the warmest temperature ever observed there in January.

Precipitation was generally light over most of the Nation except for portions of the Southeast and mid-Atlantic coast, where relatively heavy amounts fell as a cold front with waves pushed eastward and southward, temporarily interrupting the unusually warm weather that had prevailed since October.

January 10–16

The flow pattern amplified considerably during this week with strong ridging off the west coast warming most of the area west of the Continental Divide. The simultaneous deepening of the trough over North America led to a major cold outbreak that was of such short duration and preceded by such mild air that the weekly temperature anomalies barely hint at the severity of the cold (fig. 10A, 10B). Warm air prevailed over the eastern seaboard until the last 2 days of the week, so temperatures in that area averaged above normal.





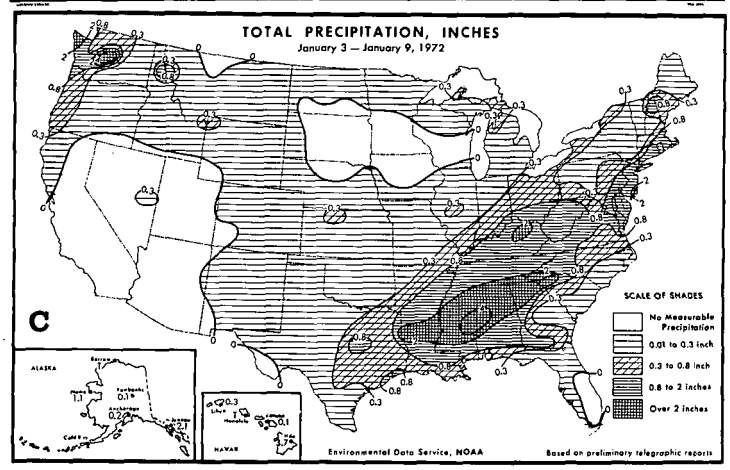
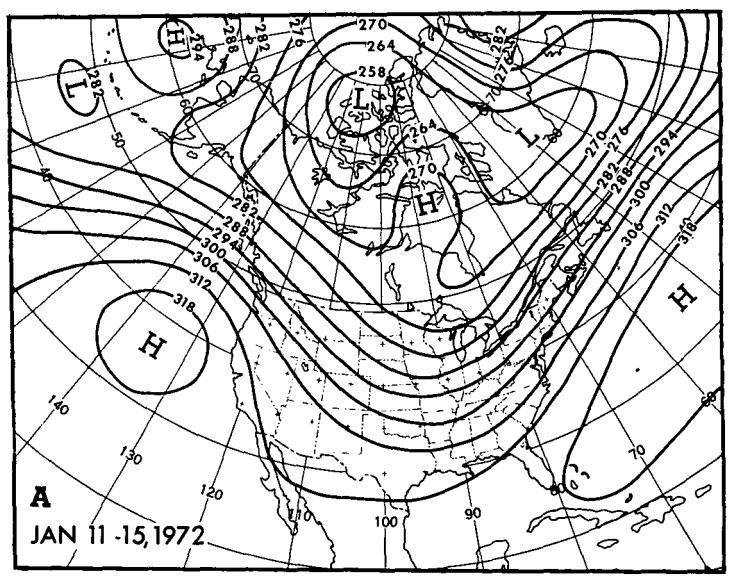
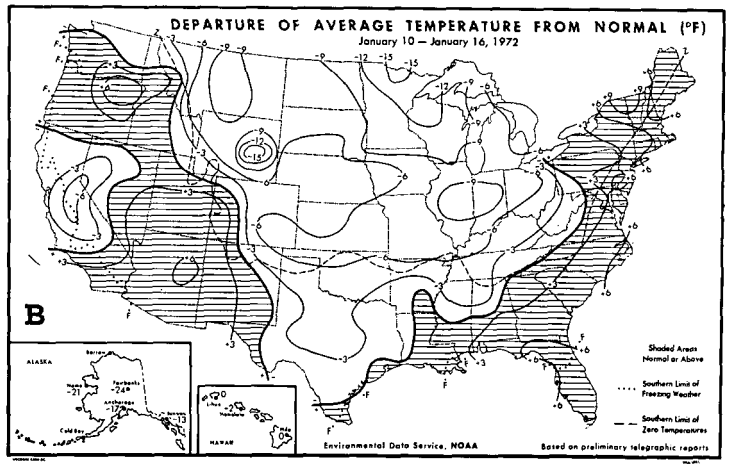


FIGURE 9.—(A) mean 700-mb contours (dam) for Jan. 4–8, 1972; (B) departure from normal of average surface temperature (°F) and (C) total precipitation (in.) for week of Jan. 3–9, 1972 (from Environmental Data Service and Statistical Reporting Service 1972).





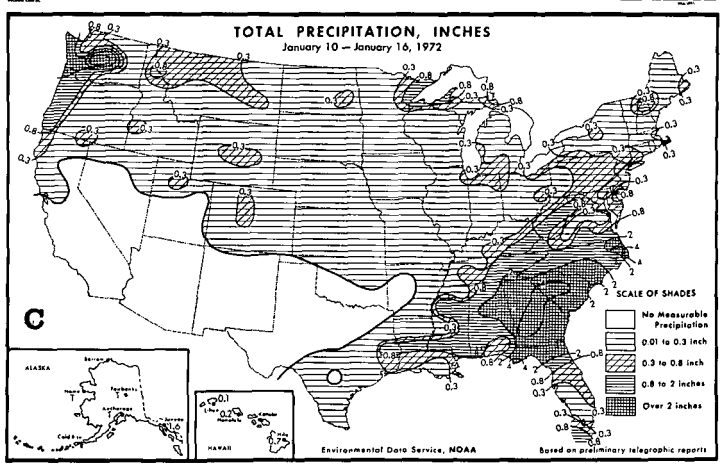


FIGURE 10.—Same as figure 9, (A) for Jan. 11–15, 1972; (B) and (C) for week of Jan. 10–16, 1972.

Temperatures plunged by more than 70°F within a 3-day period over a wide section of the Nation from the Northern Plains States southward to the Tennessee Valley and eastward to Virginia. The most remarkable temperature fall occurred at Casper, Wyo., where the mercury plummeted 76°F within 48 hr from a relatively mild 36° to −40°F, the lowest temperature ever observed at that location. A reading of −39°F at Duluth, Minn., also set a new all-time low temperature mark, and −17°F at Toledo, Ohio, equaled the all-time low record. The temperature averaged −22°F, 37°F below normal, on the 14th at Sioux Falls, S. Dak., for the coldest day on record, and −18°F at Milwaukee, Wis., the next day established a similar record there. Several stations in the Great Lakes area reported the lowest maximum tempera-

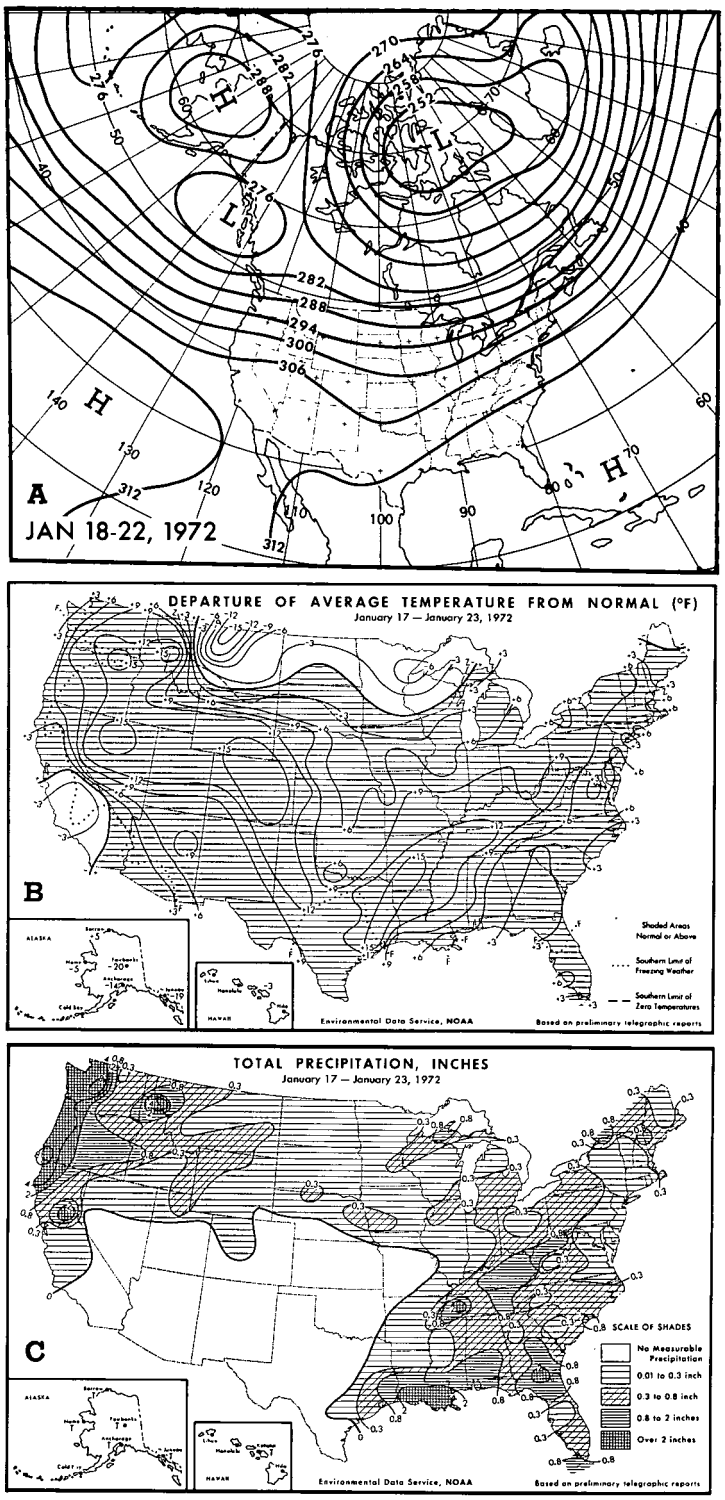


FIGURE 11.—Same as figure 9, (A) for Jan. 18–22, 1972; (B) and (C) for week of Jan. 17–23, 1972.

ture of record on the 15th, as the mercury was unable to rise above −10°F in some places. The cold air became convectively unstable with superadiabatic lapse rates over Lake Michigan's open water, and as many as a dozen waterspouts were simultaneously visible at Milwaukee.

Precipitation was heaviest over the Southeast again (fig. 10C), due to convective activity in the warm air prevailing there. Tornadoes and severe thunderstorms were observed in the vicinity of Atlanta, Ga., and Columbia, S.C., on the 10th. A storm moving rapidly inland on the 11th from the Pacific Ocean caused damaging winds with gusts of whole gale force or stronger at several places in the Northwest. Spokane, Wash., established a new record fastest mile of 59 mi/hr and Lander, Wyo., reported a peak gust of 92 mi/hr.

January 17–23

The 700-mb pattern again flattened during this week as ridging over Alaska and the Bering Sea led to rapid cyclogenesis in the Gulf of Alaska and a flattening of the ridge off the west coast (fig. 11A). Mild air of Pacific origin flooded almost the entire country, with some areas averaging more than 15°F above normal. Only the extreme northern border with Canada and a residual inversion area in California (fig. 11B) remained cold.

The temperature recovery was so rapid in some localities that record daily maximum temperatures were set only a few days after the record cold of the previous week. At Jackson, Miss., the temperature established daily records of 82°F on the 13th, 15°F on the 16th, and 81°F on the 19th. Similarly, at Nashville, Tenn., records of 74°F on the 13th, 2°F on the 15th, −1°F on the 16th, and 78°F on the 24th were established. The 78°F reading on the 24th also equaled the highest ever observed at Nashville during January and was part of a warn outbreak which also equaled the January high of 83°F at both Lubbock, Tex., and Roswell, N. Mex., on the 23d. Further north, the temperature jumped 78°F at International Falls, Minn., from −42°F on the 14th to 36°F on the 17th.

Precipitation was moderate over most of the northern and eastern portions of the Nation, with the southwest quadrant remaining rainless, but extremely heavy amounts of up to 8 in. fell west of the Cascade Mountains where strong flow from the Pacific Ocean crossed the mountains at right angles (fig. 11A, 11C). Some flooding occurred, and Eugene, Oreg., reported a record 24-hr rainfall of 4.26 in.

January 24–30

During the final week of the month, the flow pattern amplified again; this time, however, the whole country except for the Southern Rocky Mountains and Gulf Coast States turned cold as the westerlies moved southward (fig. 12A, 12B). This cold outbreak was nearly as severe, but longer lasting, than the one during the middle of January throughout the Northern Plains States and Mississippi Valley, and weekly average temperatures were more than 24°F below normal at some locations. Between the 24th and 29th, temperatures remained below 0°F for 108 hr at Des Moines, Iowa, 111 hr at Rochester, Minn., and 116 hr at St. Cloud, Minn.

While Arctic air spilled over the Continental Divide into the Pacific Northwest in response to ridging in the Gulf of Alaska, a storm that had its origin near Japan only 5 days earlier moved to the Oregon coast and produced a heavy snowstorm over Washington. Seattle, Wash., had about a foot of snow, and the 20.5 in. that

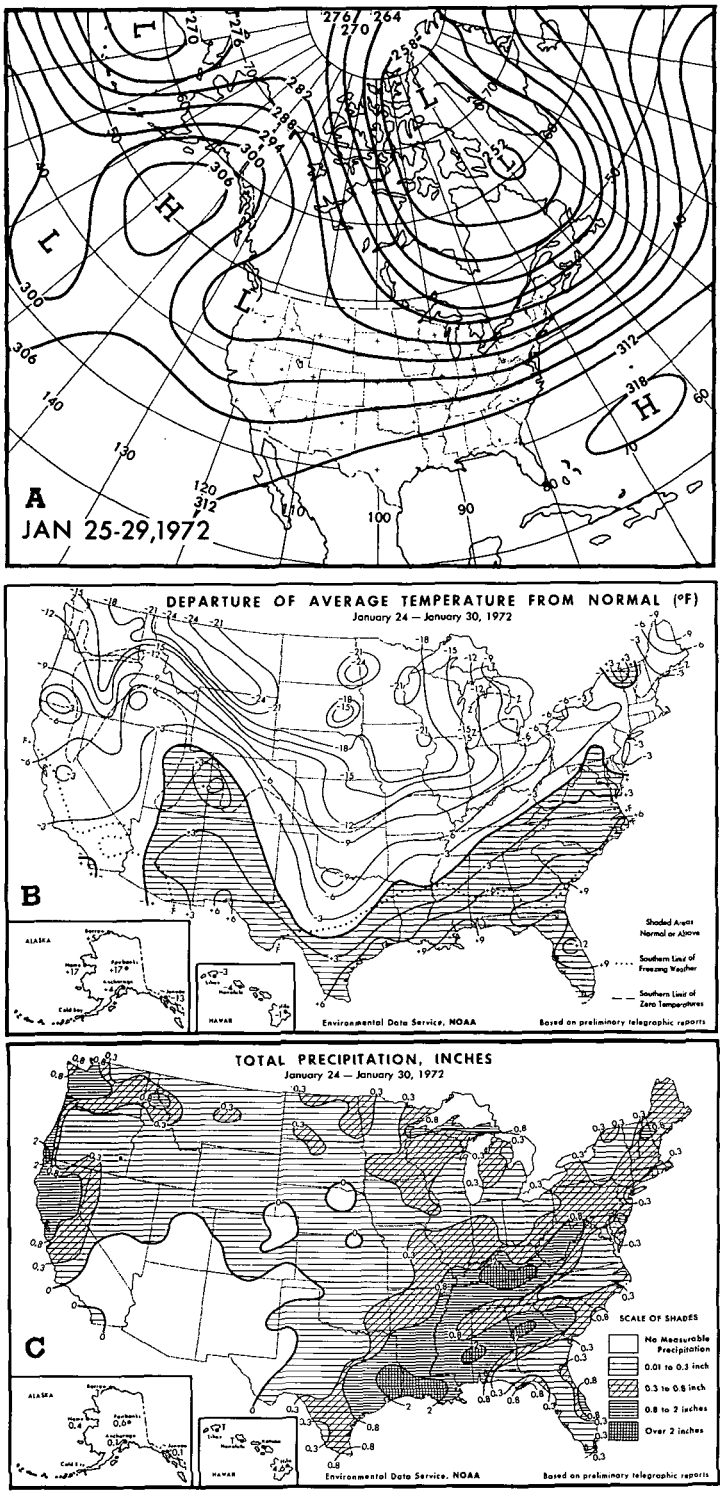


FIGURE 12.—Same as figure 9, (A) for Jan. 25–29, 1972; (B) and (C) for week of Jan. 24–30, 1972.

fell at Olympia, Wash., on the 24th–25th was a new 24-hr record. After the skies cleared, nocturnal radiation over the deep snow cover caused the temperature to fall to −7°F, a new all-time low for Olympia.

Another storm at the same time created blizzard conditions along the south shore of Lake Superior and helped establish a new record snowfall for a single storm at Sault Ste. Marie, Mich. This rapidly moving storm caused wind gusts to nearly 60 mi/hr over a wide area of the Northeast, and damage was reported at several places on the 25th. Mount Washington, N.H., reported a thunderstorm with snow as the system passed.

Another, weaker storm later in the week with an extensive area of overrunning precipitation caused most of the precipitation over the Southeast (fig. 12C). The Southwest again remained rainless.

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